4.3 Isosceles and Equilateral Triangles

Goal Use properties of isosceles and equilateral triangles.

VOCABULARY

Legs of an isosceles triangle The congruent sides of an isosceles triangle are called legs.

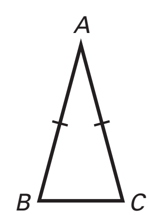
Base of an isosceles triangle The side of an isosceles triangle that is not a leg is called the base.

Base angles of an isosceles triangle The two angles at the base of an isosceles triangle are called the base angles.

THEOREM 4.3: BASE ANGLES THEOREM

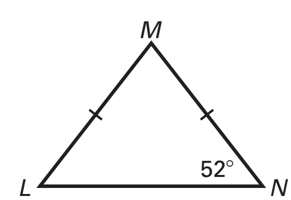
Words If two sides of a triangle are congruent, then the angles opposite them are congruent.

Symbols If $\overline{AB} \cong \overline{AC}$, then $\angle B \cong \angle C$.



Example 1 *Use the Base Angles Theorem*

Find the measure of $\angle L$.



Solution

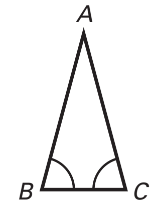
Angle L is a base of an isosceles triangle. From the Base Angles Theorem, $\angle L$ and $\angle N$ have the same measure.

Answer The measure of $\angle L$ is 52°.

THEOREM 4.4: CONVERSE OF THE BASE ANGLES THEOREM

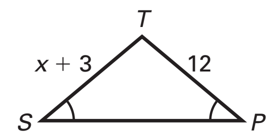
Words If two angles of a triangle are congruent, then the sides opposite them are congruent.

Symbols If $\angle B \cong \angle C$, then $\overline{AC} \cong \overline{AB}$.



Example 2 *Converse of the Base Angles Theorem*

Find the value of x.



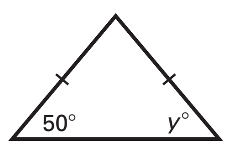
Solution

By the Converse of the Base Angles Theorem, the legs have the same length.

$TS = TP$	Converse of the Base Angles Theorem
$x + 3 = 12$	**Substitute for** TS **and** TP**.**
$x = 9$	**Subtract** 3 **from each side.**

Answer The value of x is 9.

Checkpoint Find the value of y.

1. 

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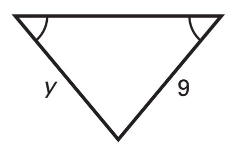
2. 

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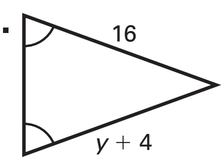
3. 

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THEOREM 4.5: EQUILATERAL THEOREM

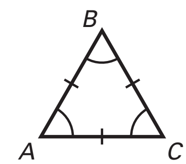
Words If a triangle is equilateral, then it is equiangular.

Symbols If $\overline{AB} \cong \overline{AC} \cong \overline{BC}$, then $\angle A \cong \angle B \cong \angle C$.

THEOREM 4.6: EQUIANGULAR THEOREM

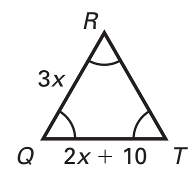
Words If a triangle is equiangular, then it is equilateral.

Symbols If $\angle B \cong \angle C \cong \angle A$, then $\overline{AB} \cong \overline{AC} \cong \overline{BC}$.



Example 3 *Side Length of an Equiangular Triangle*

Find the length of each side of the equiangular triangle.



Solution

The angle marks show that $\triangle QRT$ is equiangular. So, $\triangle QRT$ is also equilateral.

$3x =$	$2x + 10$	**Sides of an equilateral triangle are congruent.**
$x =$	10	**Subtract $2x$ from each side.**
$3(10) =$	30	**Substitute 10 for x.**

Answer Each side of $\triangle QRT$ is 30.

Follow-Up **Compare Example 2 and Example 3.**

How are they alike? They both use congruent angles to find congruent sides, then solve for x.

How are they different? Example 2 has an isosceles triangle and Example 3 has an equilateral triangle.